18
REFINING MOTOR SKILLS
IN GOLF
A biopsychosocial perspective

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Introduction
For all golfers, especially those committed to a performance pathway, progression is not constant across involvement (MacNamara et al., 2010b). Undoubtedly, novices become more skilled with practice, largely through improvements in technical proficiency and consistency (Gentile, 1972). Indeed, skill acquisition theory explains this relative permanence of skill as resulting from increased automaticity (Fitts & Posner, 1967), a hallmark of learnt skills as execution processes become committed to subconcious control (Beilock et al., 2004). Notably, however, long-term performance gains are sometimes more difficult to achieve as practice volume increases, irrespective of skill level – often termed a ‘performance plateau’.

In fact, once skills are automatized, implementing refinements, or tweaks, presents not only the more significant but also far more challenging for golfers. Thus, players may wish to make changes across a broad front, for instance, to improve proficiency, in response to new equipment regulations (e.g., shallower grooves), course demands (e.g., lengthened holes), improved competition, ageing, or prevent/return from injury. Indeed, fixing ineffective but well-automatized movements constitutes a significant part of some coaches’ everyday role (as opposed to teaching the acquisition of new skills). Furthermore, if golfers are willing to commit to making these modifications, it would seem desirable that they be long-lasting and robust under highly pressurized conditions.

Considering the importance of successful refinement to skills that are already learnt, long-practised, and well established, these challenges have, however, received surprisingly scant research attention (e.g., Schack & Bat-Eli, 2007). Accordingly, this chapter is targeted at assisting coaches working with experienced players, whether seasoned 15-handicappers or Tour professionals. Specifically, it aims to review and critique three key dimensions to achieving successful skill refinement. Firstly, the need for an interdisciplinary perspective towards player development; secondly, the role of planning and the nature of the coach’s decision-making processes; and thirdly, the training programme required. In the following sections, implications and future research directions are offered for applied coaching practice in skill refinement.

Review of current research
The importance of an interdisciplinary perspective
As science support has become a common feature across sports, recognition has emerged for the ways in which disciplines may collaborate and integrate with the job of the coach. However, despite important and well-argued papers making this point sometime ago (e.g., Burwitz et al., 1994), uni- and multidisciplinary models still predominate. In short, truly interdisciplinary approaches, where specialists work in an integrated fashion, with strong, effective communication and towards commonly agreed objectives, are still the exception. If golfers, coaches, support practitioners, and managers would rather consult nutritionists about food, fitness consultants about training, and psychologists about mental challenges, they fail to notice that elements of all three and their interactions will typically underpin performance issues. Using this silo approach neglects the increasingly accepted fact that almost all human issues are both complex and biopsychosocial in nature. Indeed, interactions between these different elements often play an even greater part in determining behavior and outcomes than the distinct factors themselves.

An example may add clarity. A golfer may report problems with maintaining attentional focus, which, after careful evaluation, can be largely attributed to an overuse of simple carbohydrates at breakfast and poor hydration on course. Dietary changes are made, with the player announcing to her/his friends and family that she/he has decided to really work holistically on her/his game. In such a case (and not exclusive to golf; cf. Collins et al., 1993), performance may well improve resulting from changes in biochemistry (the Bio), expectancy effects, better body image in the golfer (the Psycho), and increased support, plus expectancy impacts from her/his peers (the Social). A well-informed support group will work with the golfer and coach to optimize the impact of a change, exploiting all three elements and the interactions to maximize performance effects. Importantly, the particular blend of Bio, Psycho, and Social will vary depending on many factors, for example, across golfers, the state of the change (e.g., early or later in the intervention), and the influence of those practitioners suggesting/driving the change.

The origin of knowledge is another important consideration. Regarding the science underpinning the change (which may itself be multifaceted), consumers need to be aware of the originators’ intentions. As shown by Collins and Kamin (2012), sciences can be motivated by work through, of, or for sport. Therefore, research will look to examine rather fundamental effects through the use of golf situations. For example, consider much of the work on implicit learning (e.g., Maxwell et al., 2000), where novices learn a very simple putting task (e.g., Flanagan, 1972), in such cases, the authors’ motivation is to increase their knowledge of implicit learning through use of a golf-like task. It would, therefore, be questionable to uncritically transfer and apply these results to work with Tour professionals. By contrast, the Five-A Model (Carson & Collins, 2011), which is addressed later, was developed for application using what is known as a pragmatic approach (cf. Giacobbi Jr. et al., 2005). Add to these sources the bewildering array of gurus and experts available through social media (MacNamara & Collins, 2013) and the challenge becomes even greater. Sound advice is to always be aware of the source and intention of the advice, applying a dose of healthy critique, or even scepticism, to ideas before they are tried and tested with performers.

These concerns notwithstanding, it is an important realization that coaching for technical refinement should be fundamentally biopsychosocial in nature and exist within an ongoing player–coach relationship. Accordingly, the skilled coach should be aware of the contribution of each of the three elements, as well as their interactions, towards player performance and
progress. Coaching is certainly not one-dimensional or undisciplined, even if so many of the coaching and performance aids currently on the market are!

So, what might a truly biopsychosocial approach look like? Imagine that coach and player have decided to implement technical change. The predominant focus of the coach is, traditionally at least, on the bio — the technical change itself. Building on previous points, a comprehensive treatment will also address the other two elements. The coach will address the psycho by ensuring the golfer’s confidence in the change, by maintaining confidence in progress, and by generating a positive view of the outcome to ensure motivation. From a social perspective, the coach will work to gain support for change from the golfer’s immediate group. Avoiding dissenting voices as the change is made is essential. These ideas are now extended into the early stages of technical refinement, a time when the psychosocial dimensions are particularly important.

Planning and decision-making

The need for a comprehensive biopsychosocial approach is particularly apparent in the early stages of refinement. Without careful and considered analysis, plus a strong selling job, there is a significant risk that the wrong decisions will be taken or, just as damaging, good decisions not followed through. Accordingly, coach and player will first need to ensure due diligence when considering making a change, weighing up the pros and cons of refinement against other options (cf. Toner et al., 2012). Crucially, one must ask if the change is worth it. Subsequent sections will testify that technical tweaks take time, especially when the skill must be reacclimatized to ensure pressure-proofing. Accordingly, many considerations come into play, such as the player’s age and when/s he needs to peak next; that is, how long until peak performance is next required. This is hard enough working with Olympic sports, for example, tweaking a judo player’s throw can take 6 months. For golf, where a 6-month absence from, or underperformance on, the Tour may necessitate requalification, the decision is even more complex.

Once these difficulties are addressed, it is then possible to get into even more devilish detail. How will the refinement take place? Can some waymarks be set so that progress can be monitored and disseminated to all concerned? Will any specialists be brought in to help and, if so, does the need to get individuals completely trusted by the player add additional time to the planned schedule? Hopefully, this brief tour through the challenges of change is sufficient to evidence how carefully such decisions need to be made. Ultimately, coaches’ and players’ accounts show that changes are all too often initiated without sufficient thought (Carson et al., 2013). Indeed, coaches may often keep fiddling with skills inappropriately through a desire to contribute when the situation is a perfect environment for ‘less is more!’ Elements of role clarity, presentational bias, and authority often play a part in this tendency (Mallet & Pyke, 2008), which the wise coach will resist. Thus, in the present context, coaches must generate positive psychosocial support for change, a commitment and desire in the player, in parallel to the more usual bio (in this case, technical and mechanical) focus.

It is hoped that the need for a clear underpinning process is emerging. With elements of macro (overarching) and meta (thinking about) cognition, coaches in every sport, and certainly one as technically focused as golf, can benefit from the development and application of more structured higher-order thinking. Thus, in the example above, the coach will use metacognitive approaches to drive a process of decision-making, design, and implementation of technical change. Additionally, s/he will use metacognitive techniques to reflect on the process, making adjustments appropriately but not so regularly that the player is disrupted in making the change.

Interested readers should refer to an examination of these processes in adventure sports (e.g., Collins & Collins, 2015), which clearly demonstrates transfer at both macro and meta levels.

As these and other papers demonstrate, macro and metacognitive approaches are best considered under the umbrella approach of professional judgment and decision-making (PJDM). At its simplest, PJDM stresses the importance for a coach to consider the ‘why’ as much as, or even more than, the ‘what’ and ‘how’ of coaching. Inevitably, therefore, alternatives are always framed and critically considered, generating a more expertise-based approach to coaching. Indeed, this approach is viewed as taking coaching beyond the overly structured and reproductive system of competencies, which currently predominates in many coach accreditation programmes (Collins et al., 2015a).

In this regard, it is worth noting that such levels of macro and metacognition are characteristics of professions (cf. Winter & Collins, 2016). As Cur (1999) explains, when distinguishing teaching as a profession, the existence of a distinct knowledge base and clear autonomy of practice are key characteristics. Similarly, optimum golf coaching should be built on a specific and highly individual blend of techniques, drawn from a large library of knowledge on the basis of careful and ongoing reflection and weighing up of options.

Therefore, reflecting these twin ideas of biopsychosocial and PJDM, the next section presents a systemic structure within which the fine-tuning can take place. As another comparison, this structure provides the basic recipe against which the creative chef/coach can develop a refined and bespoke solution to meet the specific needs of each particular player. To push the principles of meta and macrorecognition, a five-part process is suggested, which can be used at major decision-making stages. Accordingly, the truly reflective coach will follow this checklist:

- ‘I have decided to . . .’
- ‘Because . . .’
- ‘But I considered these options . . .’
- ‘And would have taken this alternative if the circumstances were changed to . . .’
- ‘I will check my decision in X months and, if I was right, would expect to see . . .’

Consequently, alternatives are always considered and evaluated, countering the tendency to go with recipe approaches that have reportedly worked for others. There is a real tendency to equate the quality of performer outcome with the quality of coach input (‘she’s a great performer so he must be a great coach!’ cf. Nash et al., 2012) and golf is equally susceptible to this bias. The best counter is to always critically consider alternatives, to check with peers on the whys and wherefores of how they are coaching, and to regularly review progress against predicted benchmarks. Bear these factors in mind during the review of the structure and design of refinement-focused interventions in the next section.

Training programme

A third review addresses the mechanistic underpinnings necessary to generate long-term permanent and pressure-resistant refinement, thereby providing the important declarative knowledge of ‘what needs to be done’ and ‘why’, as well as the procedural knowledge of ‘how to do it’. Unfortunately, many golfers struggle to bring about such change for a variety of reasons. Despite this inherent difficulty, however, coaching interventions must be able to cater to such possibilities and exploit these mechanisms on an individual basis as part of the approach, if they are to provide a first-class service to their clients. Of course, not all elements of training will be different for each golfer. On the contrary, common practices (or at least similar practices with
Refining motor skills in golf

some suggesting that the skill acquisition process be beneficially prevented from achieving full automation across the entire movement; in other words, too much automation is a bad thing (cf. Toner & Moran, 2015). Indeed, this would certainly concur with characteristics of elite-level athletes’ performances (e.g., Nyberg, 2015; Christensen et al., 2016), which provide the possibility to access skill components should they be necessary to maintain performance of a task at hand (e.g., intentionally execute a draw rather than a fade), and, therefore, counter any long-term advantages of always executing with an external focus of attention or under an implicit design. In summary, the proposal that one type of motor control strategy is absolutely beneficial for acquiring, performing, and refining motor skills is absolutely unrealistic and undesirable in absolutely every case. In short, it depends!

Alternatively, successful skill refinement requires a non-linear, transitory process. Notably, the Five-A Model proposed by Carson and Collins (2011) – a five-stage process designed to promote long-term permanence and pressure resistance – expressly encourages conscious deautomatization of the technical aspect (not every aspect of movement) requiring modification within the early ‘awareness’ stage (Christina & Cosco, 1988; Bellock et al., 2002; Oudshoorn et al., 2007). That is, of course, having already conducted a case formulation to decide whether refinement is necessary, what to refine, how, why, and when during the previous stage of ‘analysis’ (cf. the previous section). Accordingly, the golfer actively retrieves, through a narrow internal focus of attention, the flawed aspect of the memory representation and inevitably experiences a temporary regression in motor control. Such practice is, therefore, entirely counter to implementing a completely external focus of attention or implicit strategy (e.g., dual-task condition), but essential if it is to undergo permanent learning and practice.

Of course, deautomatization can be very frustrating for the golfer as performance dips (Carson & Collins, 2016b). Therefore, it is crucial to ensure buy-in and trust between golfer and coach, as described in the previous section. Indeed, a thorough analysis would have confirmed that a golfer was ‘change-ready’, equipped with the mental skills to employ the required techniques (e.g., internal imagery), and sufficiently well supported by their caddie, psychologist, family, manager, teammates, and/or friends to maintain focus on and motivation for the job at hand. Given the potential for mixed messages within a close multi-stakeholder environment, however, each would be wise to set ground rules regarding role clarity and interaction among the support team (Collins & Collins, 2011). Indeed, a disruptive effect is easily misunderstood as poor coaching to the unformed golfer, so consistent messages can help to enhance a subjective norm (Ajzen, 1991) and intention to stay committed.

Empirically, available data demonstrate the reality of this awareness process as not necessarily being immediate within the training session (Carson & Collins, 2015). Instead, golfers may need several sessions of focused effort to fully deautomatize the targeted swing aspect. The primary aim at this stage, however, is not the modification of movement, but simply to deautomatize the movement’s control as a ‘kick-start’ to the process.

To assist in this goal, studies (e.g., Collins et al., 1999; Hanin et al., 2002; Carson et al., 2014) have supported the use of contrast training (i.e., purposefully alternating between the flawed and desired version techniques) concurrently with intentional cuing and direct questioning. Not only does this approach call the established version into consciousness, it also generates a targeted new version – although initially weak (relative to the existing version) – within the motor memory trace. Additionally, Carson et al. (2016) showed that several find it more effective to consciously initiate refinements when hitting in front of a net versus onto an outdoor driving range, thereby reducing environmental distractions to permit a more internally directed and less outcome-oriented focus. While such practice might not be the case for all golfers, empirical study is yet to confirm this. Data certainly support the former contention, in that lower
inter-trial movement variability of individually targeted refinements was found in the former condition, thus indicating a higher level of conscious control.

So, if using the Five-A Model, having decontextualized the erroneous technique and created the realization of what needs to change, progress is required through a gradual state of ‘adjustment’ in which the new version of the technique becomes more accurate, comfortable, and accepted while concurrently representing a distinct ‘departure’ from the original, unwanted movement. Such an effect relies on increasing the practice volume of the new version by tapering out contrasts with the original and reintroducing more representative golf environments (e.g., driving range/golf course). Presenting a best-attempt self-model (e.g., on an electronic tablet; Carson & Collins, 2015) at this stage can prime the golfer and drive the modification of the memory representation, as well as provide a source of motivation (Carson et al., 2014). Once consistently achieved, gradual postamortization must take place through a reduction of conscious control towards the targeted technical aspect, within the ‘(re)automation’ stage. This process allows for the less-associated aspects of the refinement to settle in with the new version of the skill, whereby the entire movement is primed holistically through patterns of rhythmic thought (e.g., mood words), therefore acting as a ‘source of information’ (MacPherson et al., 2008, p. 289). MacPherson et al. (2009) explain such cognitions as providing a ‘screen’ from potentially maladaptive thoughts, that is, a positive distraction. Finally, as a proactive step, the skill must be pressure-proofed against all weather, including negative symptoms of anxiety. Combination training (Carson et al., 1999; Carson & Collins, 2015), that is, combining physical exertion with a high degree of technical challenge, has been employed to offer the double benefit of increased performance outcome and perceived predictability.

Notably, there are many factors to consider during use of the Five-A Model, too many to cover in detail here. As such, we recommend interested readers to other informative text (refer Hanin et al., 2002; Carson & Collins, 2011; Toner et al., 2012; Carson & Collins, 2014, 2016b). What we hope to have achieved, however, is a position against a ‘one size fits all’ approach.

Implications for the game

Given the need for such a comprehensive approach to refining skills, there are clearly many significant implications, including the training of the coach, the use and integration of any support specialists, and the prerequisite characteristics of the golfer. Addressing the former, a PJDM approach will focus on generating a case formulation, as well as implementing and auditing working practice, therefore requiring a sufficiently broad declarative and procedural understanding of sport sciences as a whole. The effective coach will not solely specialize; rather, training must facilitate knowledge across the ‘-ologies’ and be in context for optimum impact. Coaches will be encouraged and provided with a range of opportunities to think critically when evaluating research/evidence-based practice, discover the important factors that coaching decisions depend on, and conduct meaningful, light-on-description self-reflections referencing their intention for impact, with ongoing auditing processes involved. Indeed, these components will form an important aspect of coach accreditation, with frequent, less-formal, and articulated justification characterizing the style of interaction between assessor and coach. The authors suggest that the development of both macro and metacognitive skills in this way provides a stronger basis for lifelong development and an overall more capable workforce.

The use and integration of support team dynamics will also have strong implications. Indeed, it is not uncommon for the too many eologists involved – each with their own working agenda, desire to prove their discipline’s worth, and understanding of the issue – to create unwanted conflict (Collins et al., 2015b). While critical debate is of course a positive characteristic of high-performance environments (Burke, 2011), it must be carefully mediated by the coach at the right times to ensure that it offers only a beneficial impact to both the intervention design and auditing process. In fact, such appreciation also applies to other stakeholders, such as management staff, especially at the elite level, who often have the final say when it comes to finances and support provision. Ideally, the support team will function with a shared understanding and common goals, putting the golfer at the forefront of any decision made. As such, collaboration with, for instance, performance institutes, must be oriented for golf. Presentation of ideas and feedback to the golfer must be consistent, even if there exist hard-core debate and discussion behind the scenes. Therefore, establishing role clarity before the refinement is initiated is increasingly important to knowing exactly who does what, with whom, and when.

From the golfer’s perspective, technical refinement can be characterized as a transition. Since transitions often present a significant degree of difficulty and challenge (Collins & MacNamara, 2012), it is important that golfers can overcome any trauma imposed. Indeed, recent talent development research has identified several psychobehavioural skills (Psychological Characteristics for Developing Excellence; MacNamara et al., 2010a) that, when developed for and deployed at, these critical periods assist athletes to successfully negotiate the inevitable rocky road ahead. Indeed, exemplar characteristics include resilience, imagery, commitment, coping under pressure and with setbacks, goal setting, and social skills (Kanin et al., 2007; MacNamara et al., 2008; Sarkar & Fletcher, 2014). Accordingly, as a precursor to implementing refinement, coaches should ensure that golfers are sufficiently prepared during the skill acquisition process, through the development of these skills, to overcome known future transitions such as injury, expectations of playing in higher-status teams/Tours, and technical refinement. Notably, while these specific characteristics are yet to be empirically tested as holding relevance during skill refinement with experienced athletes, current work in golf suggests elements of self-presentation, bias and confidence in using mental imagery, at least, have a significant impact on the level of intervention outcome (Carson & Collins, 2015).

Summary and future directions

This chapter has challenged coaches and researchers to consider new perspectives when helping golfers refine above. Through the development and acknowledgment of the limitations of skill acquisition and performance knowledge for use during this starkly different task. Additionally, there is a need to broaden the application of coaches’ (and other stakeholders’, including management at the elite level) understanding to cater for inherent and complex biopsychosocial interactions (this latter point also being pertinent to skill acquisition and performance outcomes). Therefore, the use of an expertise (PJDM) approach was suggested as an alternative to acting on a competency-driven basis. It is not anticipated that such a transition could be easy within the golf-coaching profession, especially considering its long-standing and historic roots; it will require a significant change in culture, development, and assessment structure, as well as service provision for some coaches working with some players. Accordingly, future work should seek to assess the meta and macrocognitive skills of coaches as exemplar standards of practice at different stages of professional development and when working towards different player outcomes. Equally, there is a need for greater testing of the Five-A Model with a range of golfers and a range of intended technical changes. While research to date has explored many of these elements, including longitudinal tracking, greater attention towards its validation would be much welcomed. Finally, any innovations that golf development bodies can implement towards growth in this area of research and practice are awaited with much interest.
References


